Full Option board for R/C tanks

Use and Installation Manual

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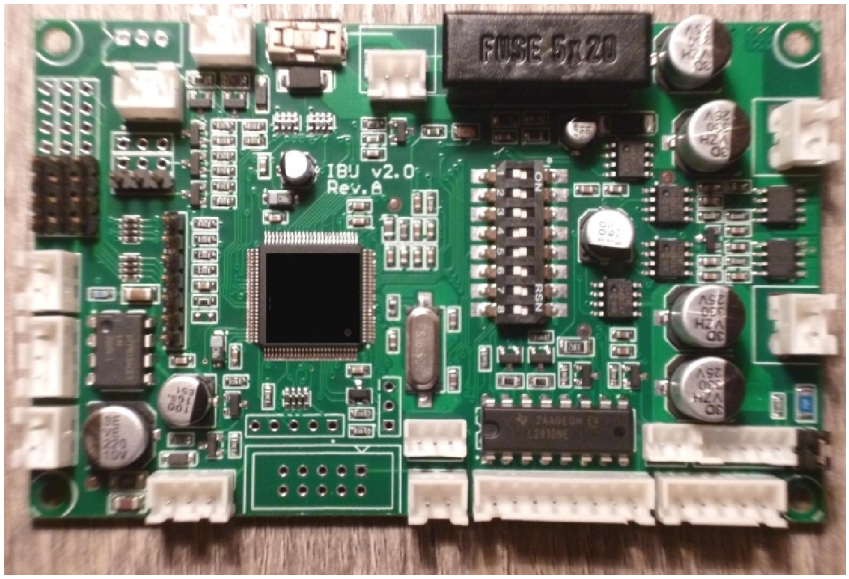
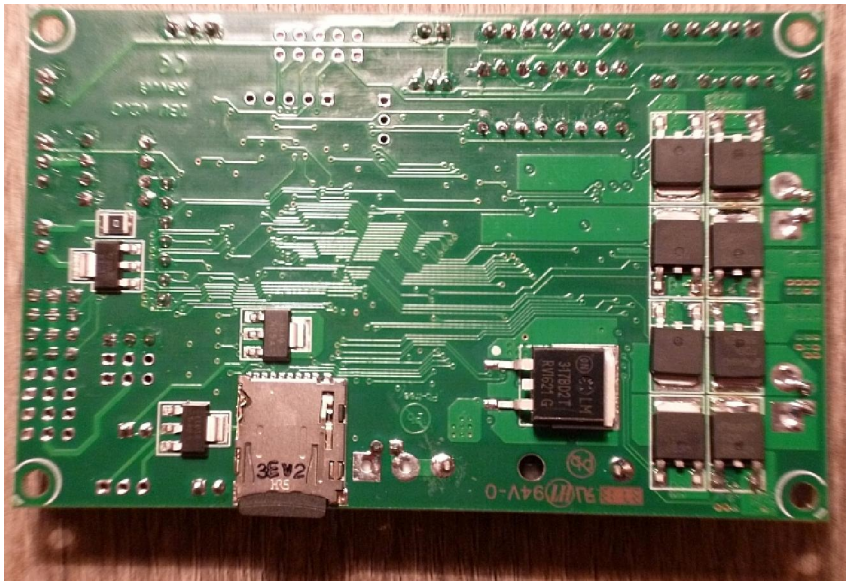
Use and Installation Manual

1. INTRODUCTION

- The Italian Battle Unit 2 Full-Option (hereafter addressed as IBU2) is an electronic board that replaces completely the electronics of a RC tank, allowing it to battle according to Tamiya[tm] IR, customize all sound effects, and use a standard 4 channel proportional transmitter (AM, FM or 2.4Ghz) to drive the tank.

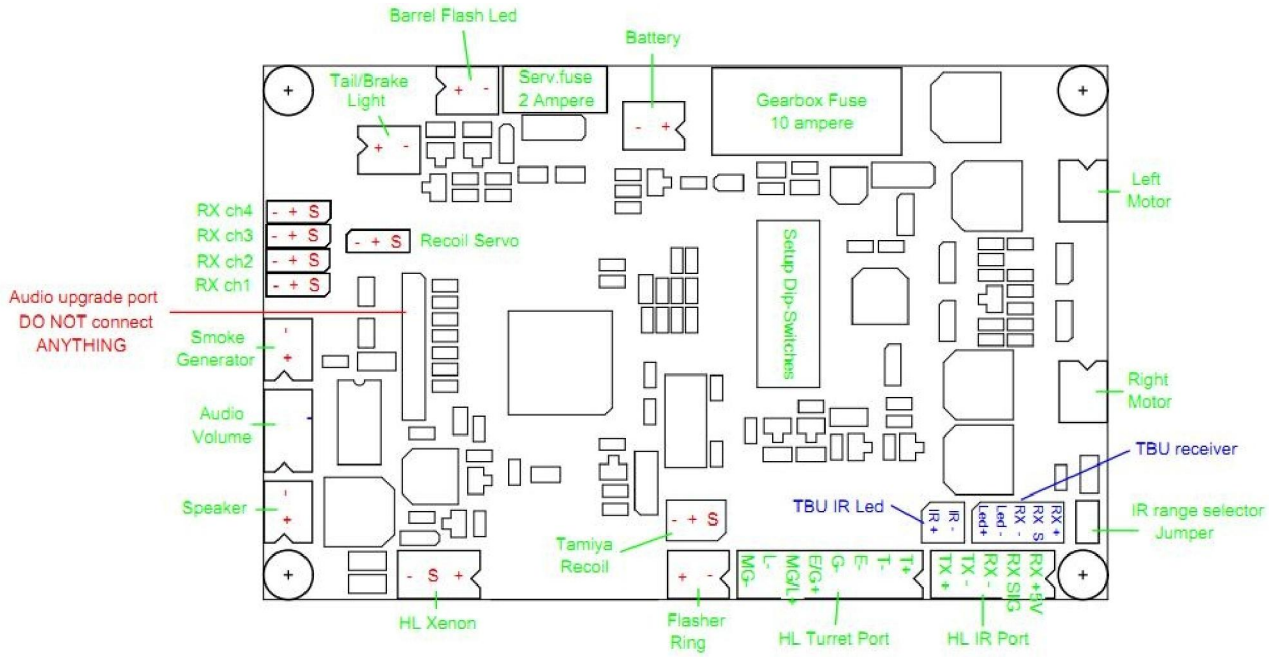
Fig. 1 IBU 2 top and bottom views





2. CHARACTERISTICS

In Fig. 2 it is shown the layout of plugs on the IBU2.



Plug HL Turret Port		
	MG	Machinegun led
	L	Lights
	G	HL Airsoft / Recoil
	E	Gun Elevation
	T	Turret Rotation

Fig. 2 Layout of the IBU2

2.1 Plug & play installation on Heng Long tanks

Installation requires removing each plug from the RX18 board, and connecting it to the IBU2 according to Table 1.
Installation on other electronics requires a good lever of experience, therefore it is recommended to perform it only under the assistance of the supplier.

WARNING: WARRANTY VOID in case of mis-installation or custom installations.

Plug	Connect plug removed from the RX18 position listed below
IR range selector jumper	Used to set the IR shooting range to “normal “(jumper inserted) or “short” (jumper removed for bergepanzer)
Right motor	CN7 M.R.
Left motor	CN6 M.L.
Battery	CN1 BAT
Barrel Flash Led	CN3 M.G. FIRE
Tail/brake light	Tank back-up lamp (on RX18 2.4Ghz only)
Recoil servo	Connect the standard or micro servo used in a custom recoil mechanism
Smoke generator	CN10 SM
Audio volume	CN4 VR
Speaker	CN5 SP
HL Xenon	Assemble new 3-poles plug from 5-poles plug of high intensity flash
Flasher port	Connect a series of led or the optional flasher ring (not supplied)
HL Turret Port	CN9 Turret, Lift, Shoot, Lamp
HL IR Port	CN2 IR Port
Tamiya recoil	Connect Tamiya recoil mechanics
TBU IR Led	Connect Tamiya IR shooting led
TBU receiver	Connect Tamiya IT Receiver mushroom (“apple”)

Table 1 **Plug correspondence between IBU2 and RX18**

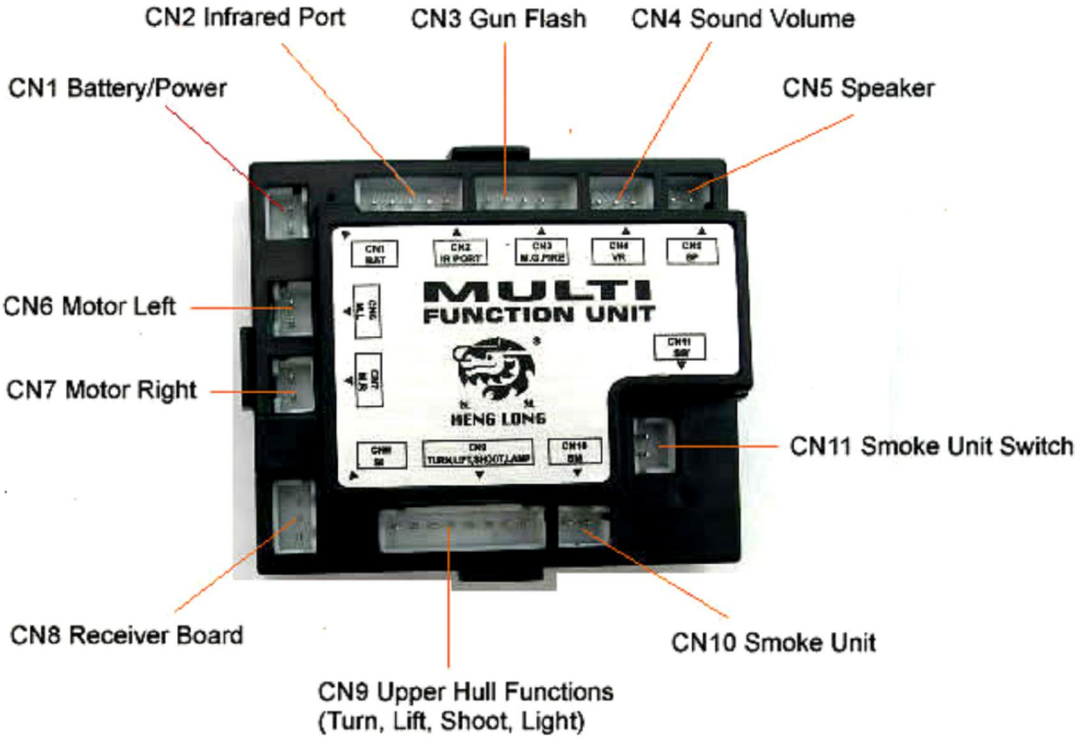


Fig. 3 Layout of plugs on the RX18

2.2 Tamiya or servo recoil option

By connecting a Tamiya recoil unit in “Tamiya recoil” plug, it is possible to simulate a barrel recoil. Same effect can be obtained by a standard servo plugged in “Recoil servo” plug.

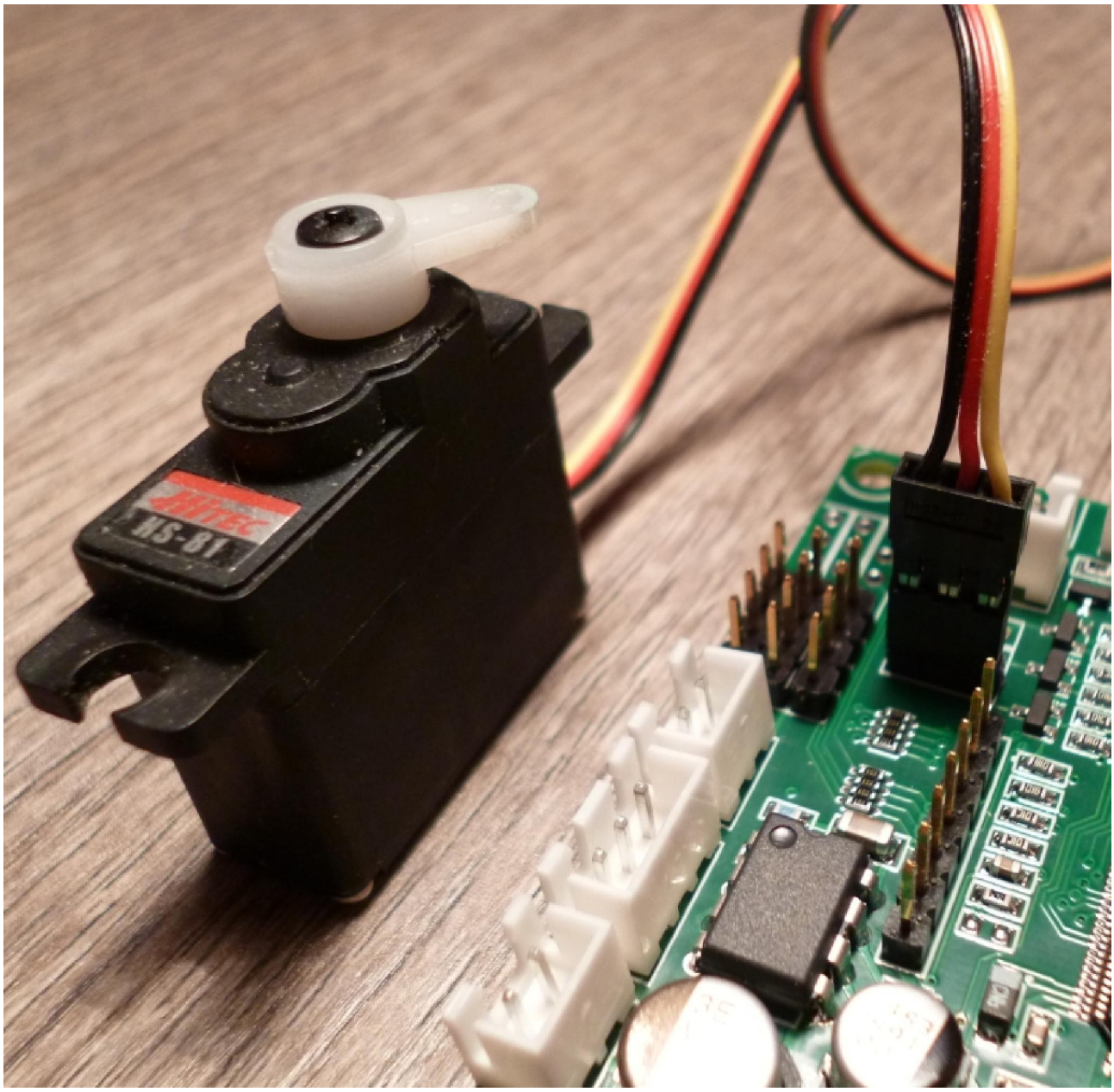


Fig. 4 Servo for barrel recoil plugged in

2.3 Battery voltage monitoring and Li-Po battery support

The IBU2 supports Li-Po battery packs, by continuously monitoring its voltage to avoid over-discharge. In case of battery voltage equal to or less than 6V, the flasher (optional) blinks. If the voltage drops more, the tank shuts off automatically.
This function avoids damaging the Li-Po battery packs in case of over-discharge.

IMPORTANT WARNING!

Battery voltage monitoring requires that the IBU2 has correctly initialized, which does not happen in case an already discharged or faulty battery is connected when trying to switch on the tank: in this case in fact the low available starting current is not enough to correctly start the system, which might in turn behave in anomalous manner.

It is therefore MANDATORY that the battery is CHARGED and WORKING when switching on the tank.

If, when switching on the tank, there is no immediate sign of activity (e.g. short flasher ring blink, sound coming from the speaker, lights turning on, servo resetting, etc.) it is recommended to immediately SWITCH OFF the tank and check the battery status.

This prescription applies to ANY BATTERY KIND connected, thus including Li-Po, Ni-Mh, Ni-Cd, etc.

WE DECLINE ANY RESPONSABILITY FOR DAMAGES TO BATTERY AND/OR ELECTRONICS IF THIS RECOMMENDATION IS NOT OBSERVED!

3. BOARD SETUP

Before installing the board, set some parameters about the tank it is destined to be mounted on. This is accomplished by the switches described below.
Switch positions, however, can be moved even when tank is already switched on.

3.1 IR shooting distance

First to set is “IR range selector jumper“ with jumper inserted (default) the shooting range of the IR led will be the maximum (battle tank), while with jumper removed, the shooting range will be limited to a couple of meters maximum. This feature has to be paired with the ‘repair tank’ setting (by Dip Switch, see next paragraph) to avoid repairing unwanted or very far tanks, or even enemy ones!

3.2 Tank function

Dip switch 1 sets the tank function (battle or repair), according table shown in Fig. 5.

3.3 Tank weight class function

Dip switches 2 and 3 set the weight class of the tank (and the corresponding momentum, if activated), according the following table and Fig. 5

Tank	Weight class
King Tiger (Tiger II)	Heavy
Tiger	Heavy
Pershing	Heavy
KV-2	Heavy
KV-1	Heavy
Elefant/Ferdinand	Heavy
Jagdpanther	Heavy
Panther G	Heavy (also Medium)
T34/85	Medium
Panzer IV F1/F2/J	Medium
Sherman	Medium
Stug III	Medium
Panzer III	Light (or Medium)

The table above can be used as a reference also for ‘repair tank’ versions derived from the same battle tank. (e.g. Bergepanzer III → Light).

3.4 Extended signalling

It is possible to enable the extended signalling on the flasher ring (optional) by setting switch 5 ON. When enabled, flasher leds in addition to ”received hit” (led on for 2 seconds) and tank destroyed (led flashing for 15 seconds), also the following information are given:

- When tank is switched on, 4 blinks shows that the board is looking for valid receiver channels. Blinking stops when 4 channels are found and initialized (and the tank can start receiving commands).
- Overcurrent absorption: 3 blinks (repeated).
- With Li-Po batteries connected an set (switch 4 ON) and battery pack voltage equal to or lower than 6V, two blinks (repeated).
- During battle, at the end of shell reload time, 1 sec single blink.

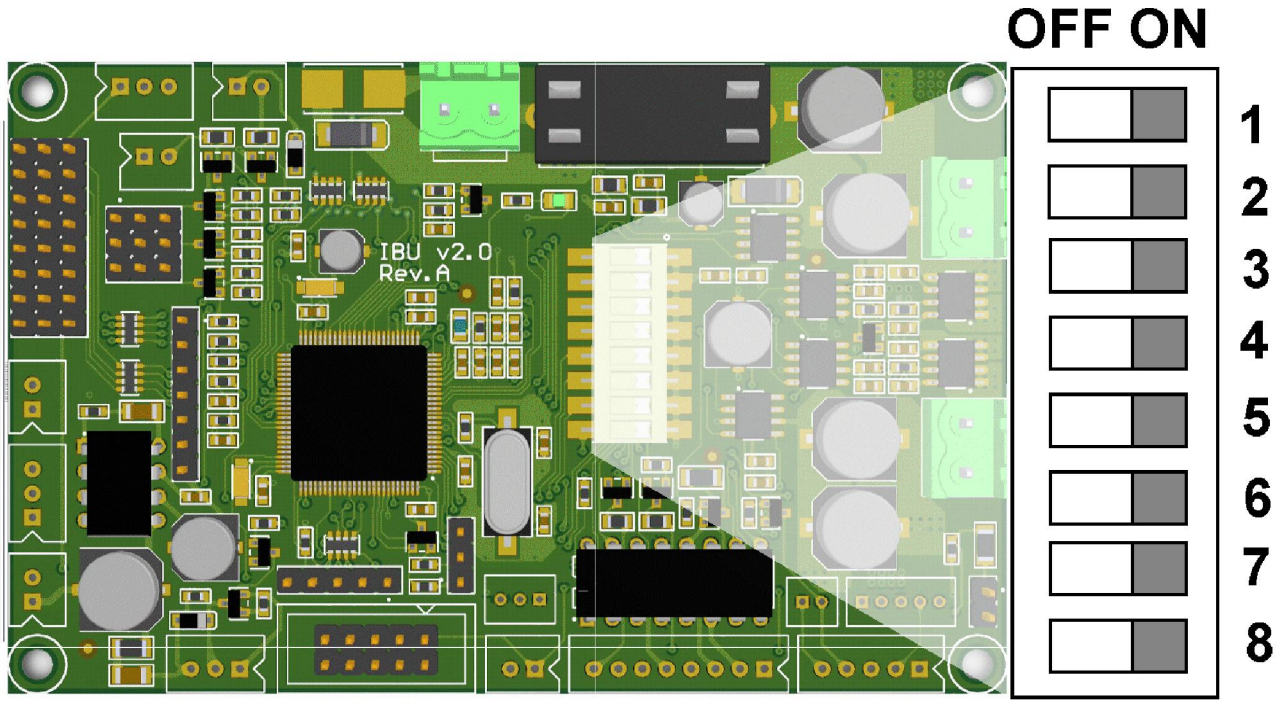


Fig. 5 DIP Switch setting

Tank function:	**Switch nr. 1**	
Repair tank (berge)([1])	ON	
Battle tank	OFF	
Tank weight class:	**Switch 2**	**Switch 3**
Ultra-light (1 hit)	OFF	OFF
Light (3 hits)	OFF	ON
Medium (5 hits)	ON	OFF
Heavy (9 hits)	ON	ON
Battery type	**Switch 4**	
Li-Po (*)	ON	
Ni-Mh or Ni-Cd	OFF	
Extended signalling	**Switch 5**	
Enabled	ON	
Disabled (only basic signalling)	OFF	
Reserved	**Switches 7 and 8**	
Transmitter sticks setup	**Switch 8**	
Transmitter stick setup	ON	
Normal operating mode	OFF	

([1]) Couple this setting with the removal of jumper in position 1

(*) Li-Po battery support monitors the battery pack voltage (2 cells, 7.4V). When voltage drops below 6V the flasher leds blink if the extended signalling has been enabled (switch 5 ON).

3.5 Coupling the IBU2 to the transmitter/receiver

- Connect the receiver cables (Fig. 6) and verify that there's no Reverse or Dual Rate set on the transmitter channels.
- Turn on the transmitter and the tank.
- Wait until receiver and transmitter align to each other.
- Move the dip switch 8 (Fig. 5) to ON position.
- Move both transmitter sticks fully to all directions.
- Move switch 8 to OFF.
- The board is now coupled and configured for using with your transmitter.

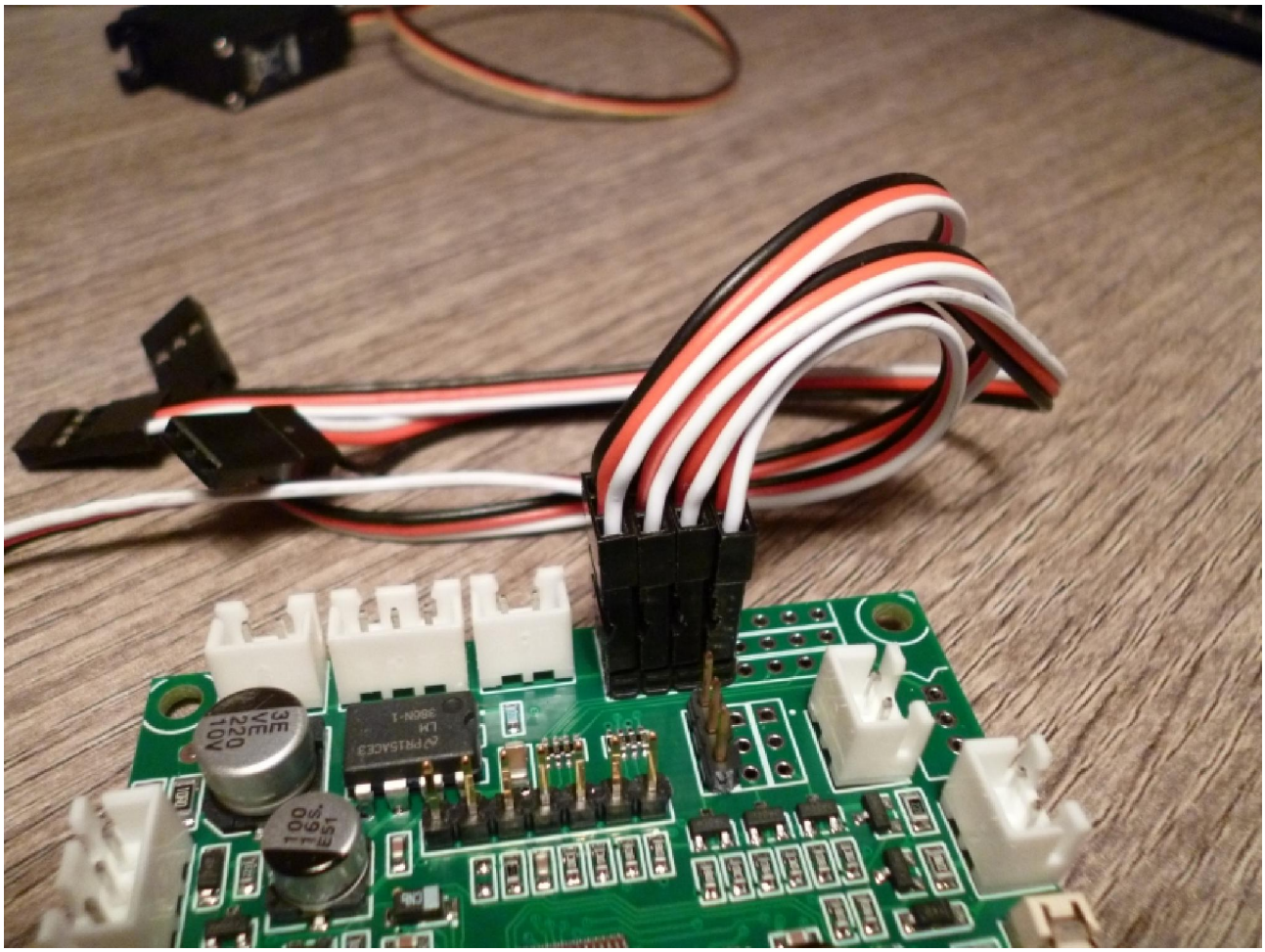


Fig. 6 Receiver cables

3.6 Adapting the HL Xenon high intensity flash

The original HL xenon flash can be easily adapted to the IBU2. Just extract (using a pointed tool) the 3 wires coming from the flash unit from the original 5 wire connector and insert them into a 3-wire plug as shown in Fig. 7. Then just plug the 3 wire connector into the “HL Xenon” port.

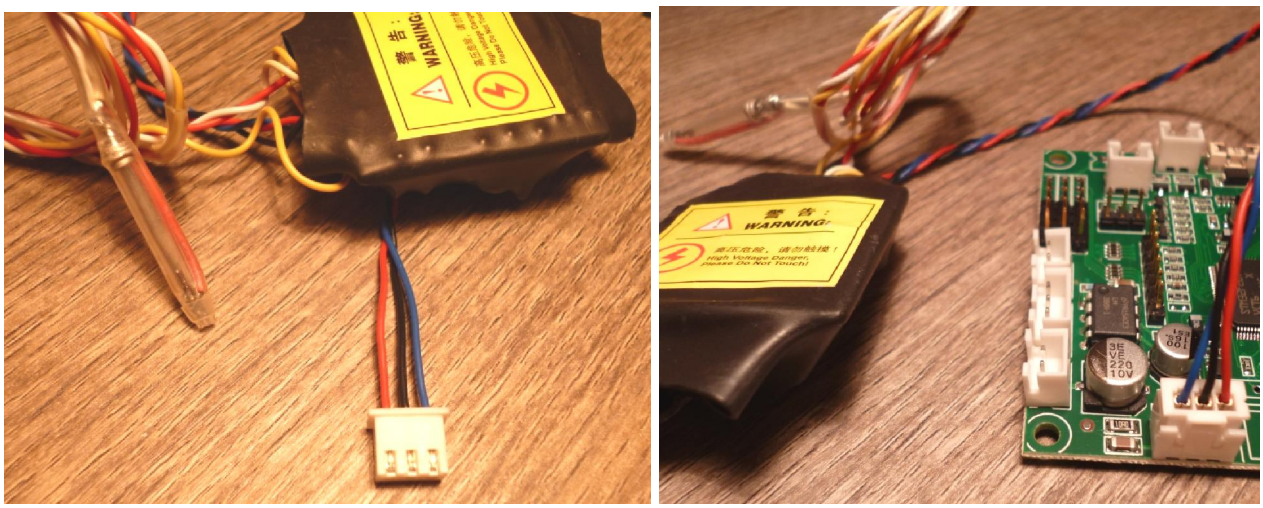


Fig. 7 Adapting the Xenon flash

3.7 Using an alternative IR receiver apple

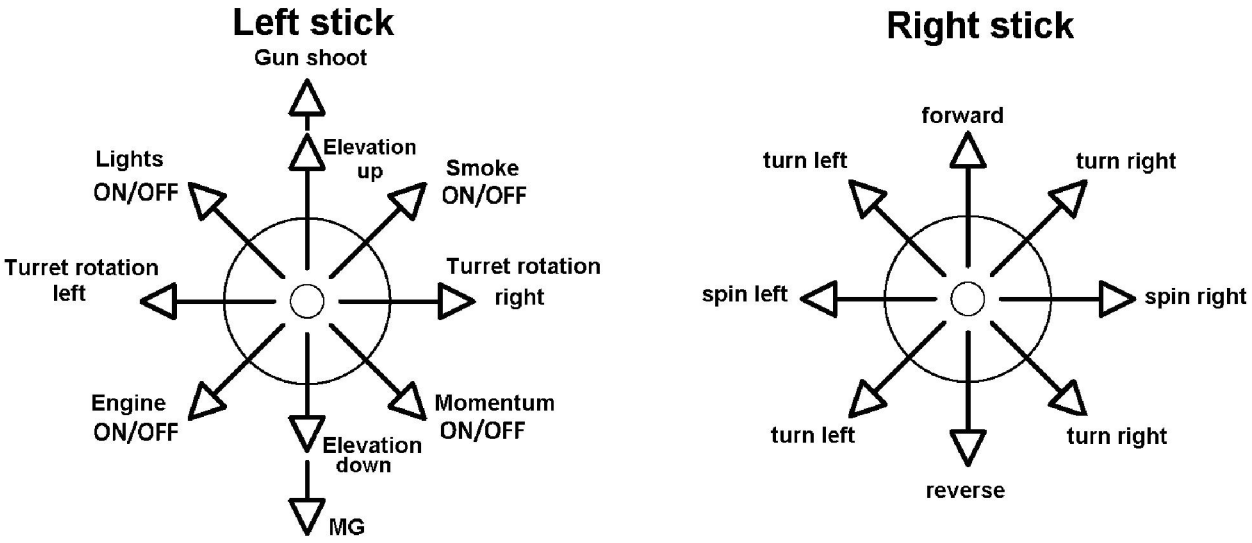
It is possible to **directly** connect a Tamiya™ or Impact™ IR receiver to the “TBU receiver” port, thus improving the receive range of IR signals.

4. TANK CONTROL

Make reference to Fig. 8 for radio control setup.

4.1 Movements

- Turn the tank on and wait for the flasher to stop blinking.
- Try to rotate the turret or to shoot: if the IBU2 is correctly setup and the radio gear is working and initialized, it should be already possible and you should hear the manual turret rotation sound.
- Switch the smoke generator ON if you want to use it. Default is OFF to avoid burning the heating wire in case of lack of smoking oil. The flasher blinks to signal the smoke generator insertion.
- Turn the engine on (left stick, lower left for 5 seconds) and wait for the startup sound to play until the engine sound goes idle.
- Try to drive the tank by moving the right stick forward and backward, and right/left for steering. Check that tank movements correspond to stick position.
- Try to control turret function with the left stick.
- If some movements are inverted, it is necessary to reverse the corresponding channel either on the transmitter or by changing the channel parameter in the “IBU2.INI” file on the microSD card (see chapter related to the IBU2.INI file, later)..



1 – Ch1, Throttle – Forward (accelerate) /Reverse (brake)
2 – Ch2, Steering – Proportional turn / Superspin
3 – Ch3, Gun shoot / Barrel elevation / MG
4 – Ch4, Turret rotation

Fig. 8 Stick commands and corresponding channels

4.2 Other commands

Beside the basic commands, the following functions can be controlled by the transmitter:

- **LIGHTS CONTROL: left stick up/left** for 5 secs to switch light on and off
- **SMOKE GENERATOR: left stick up/right** for 5 seconds to switch smoke on and off (when engine is running). Activation/deactivation of this feature is signaled by a blink on the flasher.
- **MOMENTUM (INERTIA SIMULATION) ON/OFF: left stick down/right** for 5 seconds to insert/remove momentum. Activation/deactivation of this feature is signaled by a blink on the flasher.
- **BARREL ELEVATION (up/down): left stick up/down (half way)**
- **MACHINEGUN (MG): left stick down (all way)**

4.3 Battling

- Push the left stick to shoot: you can hear the 'boom' sound and see a muzzle flash led (if any in the barrel) and the IR battle system transmits its pattern signal.
- After shooting, for a time variable from 3 (light tank) and 9 seconds (heavy tank) it is not possible to shoot again (reload interval). At the end of the reload interval, the red leds of the Flasher (optional) blink once (1 sec), to let you know that the gun is reloaded and that it is possible to shoot again.
- When the tank is hit by a Tamiya compatible IR signal, the red leds of the Flasher stay lit for about 2 seconds, and the motors might be slowed according to Tamiya specs.
- One hit point is subtracted from the tank total.
- If the tank does receive the final hit, the IBU2 switches the tank off, the red led blink for about 15 seconds and the tank must be considered 'destroyed'. Afterwards, the 'rebirth' sound effect is played and the tank return to the starting condition.

4.4 Repair tank

If DIP switches are set in 'repair tank' mode, the tank won't be able to damage the enemy. Instead, it will be able to restore the hit points of a damaged tank (provided it is not completely destroyed), if equipped with an IBU or IBU2, by "shooting" him in short range the repair code through the IR led.

When using this function, the repair tank stops moving for some seconds (according to its weight class, 3, 5 or 9 seconds), and it is vulnerable to enemy shoots. At the same time, the muzzle flash led blinks to simulate a soldering light, and the repair sound effect is played. After this time it can move again into safety and take cover.

The damaged tank, if reached by the IR repair signal, begins restoring its hitpoints (the process is signalled by fast blinking of the red leds), and it cannot move nor battle. One lost hitpoint is recovered every 5 seconds (the blinking stops for a little after each recovered hitpoint). During the repair, the relevant sound effect is played.

If during the repair process the tank is hit, the repair is interrupted with recovered hitpoints, and the tank recovers movement and battling ability (if the hit did not destroy it).

When setting the vehicle as 'repair tank', remove IR range selection jumper in order to reduce the repair range of the IR led to 10% of normal one. This, together with a proper positioning of the IR led, will allow to perform repair on intended allied tanks only.

NOTE: Lack of removal of IR range selection jumper will allow ability to 'repair' unwillingly even tanks very far from repair tank, including enemy tanks.

NOTE 2: the repair tank cannot repair itself.

5. CHOOSE AND CUSTOMIZE SOUNDS

On the supplied microSD, soundsets for the most common tanks are supplied.
Note: To fully enjoy the better audio quality, it is suggested to replace the stock HL speaker with a better one.
To select the correct set corresponding to the tank you are putting the IBU2 on, proceed as follows:

1. With **tank switched off**, gently press on the microSD inserted under the IBU2 board to unlock it (**NOTE: DO NOT PULL THE MICROSD TO UNLOCK IT!!!**), extract it and insert it into a PC card reader (not supplied).
2. Browse to the microSD folder. Each folder contains a full set for the tank listed.
3. In the root of the microSD card are located the sound effects played by the IBU2. Each wave file is associated to a different function according to the contents of the IBU".INI file:

Variable in IBU2.ini file\	Audio file name (example)	Sound effect
Engine Cold ON	estartc.wav	Engine cold starting
Engine Warm ON	estartw.wav	Engine warm starting
Engine Stop	estop.wav	Engine stop
Engine Idle	eidle.wav	Engine idling
Engine Step 1	es01.wav	Motor step 1
Engine Step 2	es02.wav	Motor step 2
…		
Engine Step XX	esXX.wav	Motor step XX
Squeak Type 1	sk01.wav	Track squeak 1
Squeak Type 2	sk02.wav	Track squeak 2
Squeak Type 3	sk03.wav	Track squeak 3
Squeak Type 4	sk04.wav	Track squeak 4
Squeak Type 5	sk05.wav	Track squeak 5
Cannon	50PZIII.wav	Gun shoot
Mg	MG34.wav	Machinegun shoot
TurretEngineOn	turn2.wav	Turret rotation (when engine is ON)
TurretEngineOff	turn1.wav	Turret rotation (when engine is OFF)
Barrel	barrel1.wav	Barrel elevation
Hit	hit1.wav	Hit received
Dead	dead2.wav	Tank destroyed
Birth	Panzerl.wav	Tank resurrection
Repair	Repair1.wav	Tank repair

4. To choose the correct set, just enter the chosen tank folder (e.g.. "Panzer III"), and copy all the contents into the microSD card root, overwriting the existing files. Verify the correspondence of the sound samples with the related variables into the BU2.INI file.
5. For a particular tank variant replace the pre-set samples with custom ones taken from the 'Engines', 'Cannons', 'Marches', 'Turret', 'Barrel', 'Hit' folders.
6. Also the present manual (in both English and Italian languages) can be found under 'User Manuals' in pdf format. The manual version may be not the latest one, though (the latest edition of the manuals can be requested from the supplier).
7. Extract the microSD card from the PC reader and reinsert it into the IBU2 slot until it locks, switch the tank on and test how the new sounds play.

It is also possible to replace any supplied sound by converting any sound effect or music into WAV format, mono, 22050 Hz, 8 bit. Each sample must size must not exceed 1 Mbyte, or it will be truncated during reproduction.

Wav filenames are not important, until in the IBU2.INI file there is correct correspondence between each file and its sound effect, **but each filename must not exceed 8 characters** (plus the ".wav" extension) and cannot contain empty spaces or periods.

E.g..

"MG34_LONG.wav"	NO, not good (9 chars);
"MG34LONG.wav"	YES, good (8 chars;
"MG 34.wav"	NO, not good (5 chars but there's a space);
"MG.34.wav"	NO, not good (there's a period in the middle).

Note: some audio editing software cannot properly convert files into the required format, or they add some unwanted parts at the end of each sample, causing troubles to the IBU2. In case of problems, contact the board manufacturer.
Also avoid reformatting the supplied microSD, since some O.S. do not format it correctly.

Note 2: when changing the engine sounds with custom-made ones, there is no limit to engine rev steps (as per firmware V0.12) neither it is necessary to keep engine samples short, until all steps are correctly addressed in the IBU2.INI file. The IBU2 will automatically pick the defined steps and play them accordingly.

6. THE "IBU2.INI" FILE

In addition to setting the sound samples (as described elsewhere in this manual), this file allows you to configure some additional functions of the card to suit your needs, this tutorial describes in detail the various options.

Configuration of the servo recoil

The first configuration parameter is the following:

RecoilTimeServo = 4000; recoil servo activation time, in ms. Value range 1 .. 9999

It allows you to set the duration of the movement of recoil; the indicated value (4000) is expressed in thousandths of a second, so this value is 4 seconds.

A lower value will decrease the execution time and vice versa to a higher increase.

The permitted value range is from 1 to 9999 milliseconds.

The second parameter:

RecoilTimeServoReturn = 2000; recoil servo return time, in ms. Value range 1 .. 9999

Allows to adjust to the speed of return of the barrel in position; the value is expressed in milliseconds, and also here the lower the value used the faster will be the return.

The permitted value range is from 1 to 9999 milliseconds.

The third parameter:

RecoilInverseCmd = TRUE; recoil Flag to reverse servo direction. Value TRUE, FALSE

Allows to reverse the direction of rotation of the actuator, useful function when there are installation problems.

Configuration of the mechanical recoil

This parameter allows you to adjust the duration of the control pulse fed to the DC motor of the mechanical recoil (Asiatam, Tamiya, HL)

RecoilTimeDigital = 1000; recoil power activation time, in ms. Value range 1 .. 9999

In this example the pulse duration is 1 second; a lower value will decrease the pulse time to a higher one and vice versa the increase.

The permitted value range is from 1 to 9999 milliseconds.

Configuring the reverse of the radio channels

Each row is for a specific channel of the receiver; this function is used, in case you have an older generation radio (without memory), to avoid having to set up every time (if necessary) the reverse channel depending on the different tanks configuration.

RadioCH1InverseCmd = FALSE; Flag to reverse CH1. Value TRUE, FALSE
RadioCH2InverseCmd = FALSE; Flag to reverse CH2. Value TRUE, FALSE
RadioCH3InverseCmd = FALSE; Flag to reverse CH3. Value TRUE, FALSE
RadioCH4InverseCmd = FALSE; Flag to reverse CH4. Value TRUE, FALSE

In this example, all channels have value FALSE this means that none of the inversion channel is applied, or the commands that arrive from the transmitter are reported to the decoding circuit as well as transmitted.

Configuring the smoke generator
In case you want to use the smoke generator, there are two configuration parameters:
SmokeInitialStatus = 0; Smoke generator initial status. Values 0 (off) - 1 (on)
This parameter allows you to set whether the power of the generator is switched on automatically. (The generator can be turned on or off also from the transmitter)
In this example the value 0 (zero) means that the smoke generator is turned off at tank start-up.
The smoke generators have different characteristics from one to another, therefore, the parameter:
MinPwmSmoke = 50; smoke generator power at idle. Value range 1 .. 100
Allows you to determine how much power is supplied to the generator with the engine idling.
With the latest HL smoke generators a value of 30 is enough to keep it running with the engine idling, unlike with those of the old type requires a higher value (50).
The smoke generator speed is proportional to the position of the stick of the engine.

Configuring lights
This parameter allows you to configure the state of the lights of the tank at start-up.
LightInitialStatus = 1; Light initial status. Values 0 (off) - 1 (on)
In this case, the lights will be turned on at tank start-up, entering the value 0 (zero) the tank will start-up with the lights off.
(The lights can be switched on or off also from the transmitter)

Configuration of the rear lights and brake lights
The rear lights and brake lightst, typically 1 led (eg. On KV1) or 2 led in parallel (Leopard 2), are fed from the same output, this is modulated to obtain a low intensity for the position lights, the parameter:
TailLightIntensity = 50; Tail light intensity [1 .. 100]
Allows you to adjust the brightness of the rear lights, a lower value will decrease and vice versa a higher increase it.
Since when braking the output is modulated at 100%, if you use a value very close to this location for the lights to the braking effect will be barely visible.

The following parameter allows you to adjust the duration of brake lights when you make a braking:
BrakeDuration = 1000; Brake light ON time in ms [100 .. 5000]
The above line means that when you brake the light is turned on for one second
The permitted value range is from 100 to 5000 milliseconds.

IMPORTANT
The brake lights function works only when the inertia is inserted as in this case it becomes necessary to use the brakes to maneuver correctly.

7. BASIC TROUBLESHOOTING

Nr.	Anomaly	Possible solution
1	I switch on the tank, but nothing happens	- Battery level is low: charge the battery - Power supply connections are interrupted or wrong: check connections from battery
2	Stick to lower left does not start the engine	- Verify that turret rotates correctly with respect to the stick movement and that the gun shots when pushing the left stick forward: if not, the diagonal commands to turn on the engine and control the other functions (smoke, lights, inertia) are found in different positions. Try other diagonals.
3	I switch on the tank, but the flasher (optional) keeps on flashing	- The IBU2 does not recognize 4 valid connected channels: check connections between IBU2 and receiver
4	Turrret rotation is inverted	- Invert the turret rotation channel (Ch4) either on the transmitter or in the IBU2.ini file settings
5	The turret moves, but the tank does not!	- Before the tank can move you have to turn on the engine: see chapter 4.1.
6	No sound is played	- Verify that volume is not at zero - Verify that speaker is connected - Verify that sound samples on the microSD card are all there and correctly associated to the relevant function in the IBU2.ini file settings
7	Tank movement and/or steering is inverted	- Invert the acceleration channel (Ch1) and/or the steering channel (Ch2) either on the transmitter or in the IBU2.ini file settings
8	Gun servo recoil does not move	- Verify that the servo connector is plugged iwth correct orientation - Verify that recoil servo can move freely in the recoil direction and if needed invert the recoil movement direction in the IBU2.ini file settings
9	Gun shoots (sound is heard) and recoils but no muzzle flash is seen	- Verify polarity of muzzle flash led or connection of 3 wires if using a Xenon flash
10	The board overheats or it smells like burnt	- Immediately unplug the battery / switch off the tank: there must be some short-circuit in your wiring